



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/876,955	06/07/2001	Shirley Hemar	005329	4359
32588	7590	06/16/2004	USA/MASK/RT/OR	
EXAMINER				
STREGE, JOHN B				
ART UNIT		PAPER NUMBER		
2625		9		
DATE MAILED: 06/16/2004				

APPLIED MATERIALS, INC.
2881 SCOTT BLVD. M/S 2061
SANTA CLARA, CA 95050

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/876,955

Applicant(s)

HEMAR ET AL.

Examiner

John B Strege

Art Unit

2625

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 June 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-34 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-34 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 07 June 2001 is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>4,6,8</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claim 33 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 33 recites the limitation "said laser light source" in lines 4-5. There is insufficient antecedent basis for this limitation in the claim.

Double Patenting

3. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

4. Claim 1-34 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 2,3,7,12,13,14, and 17 of U.S.

Patent No. 6,268,093. Although the conflicting claims are not identical, they are not patentably distinct from each other because the patent 6,268,093 and the instant application disclose subject matter which is obvious over each other with the difference being between the reticle dies in the patent and the phase shift in the instant application. However, applicant describes a phase shift mask as having single and multiple dies (page 7, lines 21-23), therefore the multiple die reticles can be read as a phase shift mask.

Regarding claims 1 and 2 of the instant application, Kenan et al. (hereinafter Kenan) discloses:

A method for inspecting a phase shift mask that is used with an optical exposure system under a set of exposure conditions (col. 12 lines 27-30);
acquiring a plurality of aerial images using transmitted light, said plurality of aerial images being acquired within a process window of said exposure system and using said set of exposure conditions (col. 12 lines 31-34);
said plurality of images including a first and second aerial image wherein first image is an out of focus positive image and second image is an out of focus negative condition (col. 12 line 65 – col. 13 line 2);
and comparing first and second images to detect defects in said phase shift mask (col. 12 lines 38-40). Here detecting variations in the first die can read on this limitation because in the instant application it states that the inspection of phase shift masks requires not only finding “conventional” defects, such as

particles, but also detecting errors in the thickness of various regions of the mask (page 3, lines 18-20).

Regarding claims 11-12 and 23-24, they are similarly analyzed and rejected as the above claims 1 and 2.

Regarding the dependent claims 3-10, 13-22, and 25-34 see the Kenan dependent claims 2-19.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 1-34 are rejected under 35 U.S.C. 102(e) as being anticipated by Kenan et al. USPN 6,268,093.

The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

Claim 1 discloses, "a method for inspecting a phase shift mask that is used with an optical exposure system under a set of exposure conditions, said method comprising: acquiring a plurality of aerial images of said phase shift mask using a transmitted light, said plurality of aerial images being acquired within a process window of said exposure system and using said set of exposure conditions; said plurality of aerial images including a first and a second aerial image of a phase shift mask; wherein said first aerial image of said phase shift mask is in a first out of focus condition, and said second aerial image of said phase shift mask is in a second out of focus condition; and comparing said first and said second aerial images to detect phase defects and errors in said phase shift mask."

Kenan discloses acquiring aerial images of a reticle, and a phase shift mask (col. 5 lines 43-44, and col.11 lines 14-15) using a transmitted light (col. 6 line 10), said plurality of images being acquired within a process window (col. 6 line 11) of said exposure system and using a set of exposure conditions (col. 5 lines 52-53). The images include a first and second aerial images at different focal planes (col. 5 lines 52-53). Finally the first and second images are compared to detect defects in the reticle (col. 5 lines 56-59).

Claim 11 is similar to claim 1 except that it is an apparatus claim; therefore since Kenan also discloses an apparatus (col. 1 line 9) the same arguments used for claim 1 apply equally to claim 11.

Claim 23 is similar to claim 1 except with the additional limitations of a light source (see 3 figure 1) and an optical means having a numerical aperture diaphragm (see 12). The other limitations have already been discussed in the rejection of claim 1.

Regarding claims 2 and 12 of the instant application, although Kenan does not explicitly disclose that an image is out of focus in a positive direction and another image is out of focus in a negative direction within the disclosure, it is however found in claim 7 of Kenan. Since the assignee of the instant application and the Kenan patent are the same, the limitation in the claims will be sufficient to prove antecedent basis.

Regarding claim 3, claim 2 of Kenan discloses this limitation. This is not provided in the disclosure but the same reasoning applied above applies equally here.

Regarding claim 4, see col. 8 lines 1-26.

Regarding claim 5, see col. 11 lines 38-45.

Regarding claim 6, see col. 11 lines 59-67.

Regarding claim 7, see col. 6 lines 5-20.

Regarding claim 8, see col. 6 line 38.

Regarding claims 9-10, see col. 8 lines 46-61.

Regarding claim 13, see 16-18 of figures 1 and 2.

Regarding claims 14-18, these are all similar limitations to those discussed above and are therefore rejected similarly to claims 3-10.

Regarding claims 19-20, see col. 8 lines 46-61.

Regarding claim 21, see transmission light illumination system 5 of figure 1, and optical system 10.

Regarding claim 22, see adjustable aperture diaphragm 12 of figure 1.

Claim 24 is similar to claim 2 therefore the same arguments used above apply equally.

Claims 25-26 are similar to claims 7-8 therefore the same arguments used above apply equally.

Claims 27-28 are similar to claims 9-10, therefore the same arguments used above apply equally.

Claims 29-31 are similar to claims 13 and 3-10, therefore the same arguments used above apply equally.

Regarding claim 32, see col. 12 lines 4-20 and figure 3.

Regarding claim 33, see col. 6 lines 33-43.

Regarding claim 34, see col. 6 lines 44-67.

7. Claims 1-2, 5-6, 9, 11-16, 19, and 21-22 are rejected under 35 U.S.C. 102(e) as being anticipated by Ferguson et al. USPN 6,327,033 (hereinafter "Ferguson").

Claim 11 discloses, "An apparatus for inspecting a phase shift mask that is used with an optical exposure system under a set of exposure conditions, said apparatus comprising: a scanner for acquiring a plurality of aerial images of said phase shift mask under said set of exposure conditions; said plurality of aerial images of said phase shift mask comprising a first and a second aerial image of said phase shift mask; wherein said first aerial image of said phase shift mask is in a first out of focus condition, and said second aerial image of said phase shift mask is in a second out of focus condition;

and an image processing module for detecting variations in phase of said phase shift mask using said first and said second aerial images of said phase shift mask.”

Ferguson discloses a method and apparatus for detecting phase defects and other phase features on a photomask using differential imaging (col. 1 lines 5-10). Ferguson recites that a phase shift mask which may contain phase defects or features is illuminated by light at the inspection wavelength and the transmitted image of the mask is measured by an optical lens or objective at two focus positions in a positive and negative direction (col. 6 lines 20-30). In scanning the mask the images may be collected concurrently or sequentially in any order (col. 6 lines 33-39). Making a differential image compares the images obtained from the two separate images, in order that the variations may be detected (col. 6 line 63 – col. 7 line 3).

Claim 1 has the same limitations as claim 11, however claim 1 is a method claim. As discussed above Ferguson discloses a method and apparatus. Therefore the same arguments discussed above apply equally to the rejection of claim 1.

Regarding claims 2 and 12, as discussed above Ferguson discloses a positive out of focus condition and a negative out of focus condition.

Regarding claim 5, Ferguson discloses that in order to ensure defect free masks following fabrication, the mask manufacturer will perform an automated optical inspection of the reticle to search for unwanted defects on the mask by comparing images of the mask from the optical inspection system (col. 2 lines 44-52).

Regarding claim 6, the differential image 780 (figures 10 and 11) can be considered a map of the variations in phase by using results of the comparison.

Regarding claims 9 and 19, Ferguson discloses that the mask to be inspected for phase defects (700) is secured to the moveable stage of the inspection system (710).

Regarding claims 13-14, two inspection optics units are shown in figure 11 (731 and 732).

Regarding claim 15, this limitation has already been addressed above.

Regarding claim 16, figure 11 discloses an illumination source 721.

Regarding claim 21, figure 11 shows an illumination source 721 and inspection optics units (731 and 732) for collecting light emerging from said phase shift mask.

Regarding claim 22, Ferguson discloses a numerical aperture of the inspection object where the magnitude of the defocus can be adjusted or optimized in order to tune the sensitivity of the inspection to highlight certain phase defects or feature at a size and/or phase of interest (col. 6 lines 47-54).

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 3-4,7-8,10,17-18,20, and 23-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ferguson et al. USPN 6,327,033 in view of Shiraishi et al. USPN 5,576,829 (hereinafter "Shiraishi").

Claim 23 is similar to claim 11, except it has the additional limitations of a light source, a transmission light illumination means, and the optical means for producing a plurality of magnified aerial images of the phase shift mask under a set of exposure conditions, said optical means having a numerical aperture diaphragm. As the other limitations have already been discussed above as being disclosed by Ferguson, only these new limitations will be addressed here.

Ferguson discloses a light source (722 of figure 11) and a transmission illumination means 721 for illuminating the mask. Furthermore Ferguson discloses a numerical aperture of the inspection object where the magnitude of the defocus can be adjusted or optimized in order to tune the sensitivity of the inspection to highlight certain phase defects or feature at a size and/or phase of interest (col. 6 lines 47-54)(this can be read as the numerical aperture diaphragm).

As discussed Ferguson also discloses an optical means for producing aerial images, however it is not explicitly disclosed that the aerial images are magnified.

Shiraishi discloses a system for inspecting a phase-shifted mask where the amount of phase shift is determined in accordance with the light quantity ratio between the images of phase-shier of the inspection pattern in a defocus condition (as stated at least in the abstract). Shiraishi discloses that while the magnification of the inspection optical system 13a, 13b may be selected as desired, the measurement of the light quantity distribution is easy if the pattern 11a to 11c on the reticle 10 is magnified over the detector 16. In this case, instead of moving the reticle 10 in the direction of the optical axis AX of the inspection optical system 13a, 13b, the detector 16 may be

advantageously moved since the accuracy of position setting becomes less severe by an amount corresponding to the square of the magnification.

Ferguson and Shiraishi are analogous art because they are from the same field of endeavor of phase-shift mask inspection.

At the time of the invention it would have been obvious to one of ordinary skill in the art to combine Ferguson and Shiraishi in order to obtain magnified images. The motivation for doing so is that the detector can also be moved easily instead of the reticle. The motivation for this is provided above. Thus at the time of the invention it would have been obvious to one of ordinary skill in the art to combine Ferguson and Shiraishi in order to obtain the invention as specified in claim 23.

Claim 24 has the same limitation as claim 12 which as stated is provided for by Ferguson. The same situation applies for the following claims where there limitations have been discussed above as being disclosed by Ferguson.

Regarding claim 25, Shiraishi discloses that the direction of incidence of an illuminating light on the mask is changed (as stated in the abstract).

Regarding claim 26, Shiraishi discloses that the same illumination method may be obtained by the use of a laser (col. 6 lines 43-47).

Claim 27-28 are similar to claim 9 rejected above.

Claim 29-31 are similar to claims 14-15 rejected above.

Regarding claim 32, Ferguson discloses a post processing and review means for displaying condition of the phase shift mask as seen in figure 9.

Regarding claim 33, Ferguson discloses the defect inspection step has an inspection wavelength that is the same as the exposure wavelength (col. 2 lines 55-57).

Regarding claim 3, Shiraishi discloses that the images are passed through a Fourier transform plane which would simulate the behavior of an exposure system.

Claim 4 is similar to limitation presented in claim 23, thus the combination of Ferguson and Shiraishi applies as well.

Claims 7-8, and 17-18 are similar to claims 25-26.

Claims 10 and 20 are similar to claim 9.

10. Claim 34 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ferguson et al. USPN 6,327,033 in view of Shiraishi et al. USPN 5,576,829 and further in view of Oohashi et al. USPN 6,078,393 (hereinafter Oohashi).

As discussed above the combination of Ferguson and Shiraishi disclose all of the limitations of claim 23. Neither Ferguson nor Shiraishi explicitly disclose a homogenizer disposed in the vicinity of said transmission light illumination means for reducing speckle resulting from use of said light source.

Oohashi discloses that because the UV laser light outputted from the UV laser light source 20 is forced to pass through the diffusing filter 21 rotating around the optical axis of the UV laser light and reach the illumination optical system 22, the disorder of the phase of the interference light resulting from speckles caused by the stationary diffusing filter 21 can be randomized. This reduces speckles, improving the reliability with which the phase value of the phase shifter 29b can be measured with high accuracy (col. 8 lines 40-67).

Ferguson, Shiraishi, and Oohashi are all analogous art because they are all from the same field of endeavor of phase mask inspection.

At the time of the invention it would have been obvious to one of ordinary skill in the art to use diffusing filter as a homogenizer to reduce the speckle. The motivation for doing so would be in order to improve the reliability with which the phase value of the phase shifter can be measured and giving high accuracy. Therefore it would have been obvious to one of ordinary skill in the art to combine Ferguson, Shiraishi, and Oohashi in order to obtain the invention as specified in claim 34.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to John B Strege whose telephone number is (703) 305-8679. The examiner can normally be reached on Monday-Friday 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh Mehta can be reached on (703) 308-5246. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Application/Control Number: 09/876,955
Art Unit: 2625

Page 14

JS

A handwritten signature in black ink, appearing to read 'Bhavesh M. Mehta', written in a cursive style.

**BHAVESH M. MEHTA
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600**